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FOUR DEVASTATING MELANOPLI FOUND IN UTAH
(Orthoptera – Cyrtacanthacrinae)

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1. ARRANGEMENT

Inasmuch as this paper has economic significance, the order of treatment of the four species discussed will be in the descending order of their economic importance to agriculture in Utah. This order is as follows:

Melanoplus mexicanus mexicanus (Saussure)
Melanoplus packardii (Scudder)
Melanoplus bivittatus (Say)
Melanoplus femur-rubrum (DeGeer)

From a strictly taxanomic standpoint, the four species are arranged by Scudder (25) as follows:

26. *M. mexicanus mexicanus (atlanis)* (Saussure)
82. *M. femur-rubrum* (DeGeer)
96. *M. Packardii* (Scudder)
126. *M. bivittatus* (Say)

This arrangement indicates Scudder's idea of the phylogenetic sequence and the numbering implies groups of species coming between the numbers given, so that each of the four species is distinct from any of the other three.

Blatchley (39) gives the same arrangement. Hebard's (51) taxonomic arrangement is now the most extensively used, and is as follows:

M. bivittatus (Say)
M. femur-rubrum femur-rubrum (DeGeer)
M. mexicanus mexicanus (Saussure)
M. packardii (Scudder)

The order of discovery and description of the four species is as follows:

M. femur-rubrum (DeGeer) 1773
M. bivittatus (Say) 1825
M. mexicanus mexicanus (Saussure) 1861
M. packardii (Scudder) 1878

2. OTHER DESTRUCTIVE GRASSHOPPERS

It must not be assumed that the four species treated are the only destructive grasshoppers in Utah. Another species, *M. differentialis* (Thomas), which belongs in the same genus is, at times, highly injurious in limited areas. Up to 1942, this species has been found in Utah only along the Rio Virgin in Washington County, at Kanab in Kane County, on the Green River and at Woodside on the Price River in Emery County, on the Colorado River at Moab and at Castleton in Grand County. *Oedaleonotus enigma* (Scudder), closely allied to *Melanoplus*, is sometimes destructive to dry-farm crops in limited areas. *Camnula pellucida* (Scudder) is one of the most destructive grasshoppers to dry pastures in Utah. There are still others that deserve mention, but this paper is concerned with the four species pointed out, because they are the most devastating of the genus in Utah and because enough material and data have been accumulated to justify some conclusions.

3. MELANOPLUS MEXICANUS MEXICANUS (Saussure)
(See Pl. I fig. 1)

a: Synonymy:

1. 1861—Saussure, *Pezotettix*. (7: p. 160)
2. 1873—Thomas, *Pezotettix*. (11: p. 222)
3. 1875—Riley, *Caloptenus atlanis*. (12: p. 169)
4. 1897—Lugger, *M. atlanis*. (24: pp. 280-283)
5. 1897—Scudder, *M. atlanis*. (25: pp. 178-183)
6. 1897—Scudder, *M. intermedius*. (25: pp. 172-174)
7. 1910—Kirby, *M. atlanis*. (35: p. 512)
8. 1910—Kirby, (35)
9. 1920—Blatchley, *M. atlanis*. (39: pp. 414-416)
10. 1928—Hebard, *mexicanus*. (47: pp. 279-282)

b. Description:

Medium and variable in size. In a group of a hundred or more individuals, the two colors, brown and gray, show up most, both in the

same specimen. In some, the gray prevails over the brown, in other, brown prevails over gray. Both brown and gray vary in the populations from light to dark. The Utah collection indicates that mature specimens are lighter in both colors when they are newly emerged and that the colors deepen and darken as specimens become older.

The most conspicuous color markings are the blackish irregular lines on the upper sides of the thorax, the small blackish spots running in a narrow straight line down the length of the tegminae are narrow and long, usually reaching well beyond the tip of the abdomen, especially in males. The wings are well developed, hyaline and nearly as long as the tegminae. The upper margin of the subanal plate of the males is elevated in the center and cleft to form twin tubercles with an indentation between their bases on the caudal side. The furculae of the male are short, about one-third as long as the supra-genital plate, broad and contiguous in the basal half, very narrow and divergent in the distal half. The cerci of the male are quadrate in the basal half, narrowed one-third and cupped in the distal half.

This brief description is sufficient to distinguish *M. mexicanus mexicanus* from other species found in Utah. For more technical description, reference is made to other works, particularly Scudder (25), and Blatchley (39).

c. Measurements:

Male:

Body length:

Average for 100 specimens 21 mm.
Shortest body in 100 specimens 17 mm.
Longest body in 100 specimens 25 mm.

Hind femora length:

Average for 100 specimens 14 mm.
Shortest femur in 100 specimens 11 mm.
Longest femur in 100 specimens 14 mm.

Tegmina length:

Average for 100 specimens 20 mm.
Shortest tegmina for 100 specimens 15 mm.
Longest tegmina for 100 specimens 23 mm.

Female:

Body length:

Average for 100 specimens 25 mm.
Shortest body in 100 specimens 19 mm.
Longest tegmina for 100 specimens 29 mm.

Hind femora length:
Average for 100 specimens 14 mm.
Shortest femur in 100 specimens 12 mm.
Longest femur in 100 specimens 18 mm.

Tegmina length:
Average for 100 specimens 19 mm.
Shortest tegmina for 100 specimens 14 mm.
Longest tegmina for 100 specimens 24 mm.

d. Geographical Distribution:

Melanoplus mexicanus (Saussure) (7) was described in 1861 from specimens collected in Old Mexico. In 1875, Riley (12) discovered the species in Missouri and described it under the name *Caloptenus atlanis*. In 1876, he (14) discovered it in Illinois. In 1883, Bruner (21) gave the distribution as "Northern United States and British America." By 1897, when Scudder (25) published his "Revision of Melanopli," he had information placing the species in many localities in Canada and Mexico and all the states in the United States except New York, Rhode Island, Delaware, West Virginia, Florida, Ohio, Alabama, Arkansas, Tennessee, Oklahoma and North Dakota. Scudder's Index of 1901 (27) added Kansas, Arkansas and North Dakota to the territory. Caudell (29) added Oklahoma in 1902, and Mead (31) added Ohio in 1904, Morse (32) added Tennessee in the same year.

Riley (23) found the species in 1891 extending northward in North America "nearly to the Arctic Circle" and the "Yukon River," Scudder (26) found by 1898 "it practically covers the whole of North America north of Mexico and is found far within Mexico itself." Hebard (46) says in 1925, "It is generally distributed over all (North America) but the tropical lowlands of Mexico, reaching Northward over all the United States except peninsular Florida and California west of the Sierra Nevada Mountains. It is reported from Yukon River and Alaska."

There are 450 males and 353 females represented in the collection at the Utah State Agricultural College, taken in all the counties of the state except Garfield.

The collections were made by E. G. Titus, C. J. Sorenson, H. J. Pack, H. B. Stafford, G. F. Knowlton, W. S. Thomas, E. W. Anthon, F. C. Harmston, Lowell Cutler, M. J. Janes, Newel Fowler, D. M. Hammond and W. W. Henderson.

The collections date from 1907 to 1942. Earliest collection date

was May 30, latest October 12. The collectors were all students or teachers tied to class rooms and laboratories from October to May, which no doubt accounts for the lack of collections on earlier or on later dates.

e. Economic Importance:

This species not only covers a wide range of territory but a great many kinds of environment. It is found in all sorts of cultivated fields and infests practically all kinds of crops. Corkins (45) says "it has not been known to refuse any cultivated plant and will even gnaw dry wood such as fence posts and the handles of farm tools." It does not occur in swamps and only by accident in damp pastures or in dense forests. It is found in large numbers at low elevations and also in high mountains. Scudder (26) found it common on the top of Mount Washington in New Hampshire and at a level of 9500 feet in American Fork Canyon in Utah. Caudel (28) found the species on the summit of Pike's Peak in Colorado, and Hebard (51) reports it at elevations of 11,000 and 12,000 feet in New Mexico. Marcovitch (40) says the species "was taken on top of Clingman's Dome, elevation 6,612 feet." (Tennessee). Scudder (18) found this destructive species to be "extremely abundant" in "all parts of Colorado to Salt Lake" in 1876 and the same year (19) found it everywhere common in New England. Riley (17) found it "very common in Missouri in 1878." Bruner (21) reported it as "doing damage to crops and vegetation in general" in 1883, and Lugger (24) recorded, "This is one of our most injurious locusts, and almost always found in our state (Minnesota) in destructive numbers." By 1897, Scudder (25) regarded this species "Next to *M. spretus*—the most destructive locust." Morse (32) observed it in 1904 "nearly everywhere" in Tennessee, and said it is "perhaps the most dangerous, potentially, of any species inhabiting the region," and in this same year, Gillette (30) pronounced it "undoubtedly the most generally distributed species of locust in Colorado." Severin and Gilbertson (38) listed it in 1917 among the four species of "grasshoppers which do the greatest amount of damage in South Dakota," and Fox (37) classed it, in the same year, as the "dominant grasshopper east of the (Appalachian) Mountains. Blatchley (39) said in 1920, "This is a very common locust throughout Indiana, having been taken in every county in which collections have been made." In 1921, Morse (42) listed the species among the grasshoppers likely to cause injury in Maine. In the same year, Buckell (41) recorded that "large swarms of *Melanoplus atlanis* had been devouring every-

thing that the settlers planted during the last three years" in certain sections of British Columbia. Hubbel (44) said in 1922, "In point of view of destructiveness, this species surpasses all others in North Dakota," and in the same year (43), "This species far exceeds all others in abundance in this region" (Michigan). In 1928 Hebard (47) found that "undoubtedly *mexicanus mexicanus* is responsible for the greater portion of the damage caused by Orthoptera in Montana, both in cultivation and on the range," and the same author (48) said in 1929, "the most generally distributed grasshopper in Colorado—most destructive species to the native range—not averse to feeding on cultivated crops," and "Gillette (30) considers it one of the most destructive species to the Native range." Hebard also (49) found it "probably the most numerous grasshopper everywhere in the state." (Kansas)? Strand (50) recorded in 1934, "In many of these counties (Montana) the eggs of the lesser migratory locust (*Melanoplus mexicanus*) were so abundant that as high as 30 egg pods, each containing about 20 eggs, could be found per square foot of stubble." In 1938 Isley (54) listed it among the Acrididae of economic importance in Texas. It would seem that Ball et al (55) were well justified in recording *Meanoplus mexicanus mexicanus* (Saussure) as "the most injurious locust in the United States."

Observations in Utah lead to the conclusion that this remarkable insect is the most destructive orthopteriod in the state and this conclusion led to the examination of its economic status elsewhere, only to find the same condition in other states. It might be added, incidentally, that although this insect has been numerous in Utah, there has never been a migratory movement observed.

It would seem that among numerous species struggling for existence, *Melanoplus mexicanus mexicanus* (Saussure) has found the struggle an easy one, or has found the way of successful living. If there is a goal of perfection in locust-hood, this species seems to have arrived at that goal.

4. MELANOPLUS PACKARDII (Scudder) (See Pl. I fig 2)

a. Synonymy:

1. 1875—Scudder, *Caloptenus fasciatus, Acrydii* (*Pezotettix Caloptenus*) (13: p. 76)
2. 1877—Bruner, *Caloptenus fasciatus,* (16: p. 144)
3. 1878—Scudder, *packardii,* (18: p. 289)
4. 1880—Scudder, (20: p. 24)

5. 1883—Bruner, (21: p. 60)
6. 1903—Caudell, (29: p. 88)
7. 1906—Rehn, (33: p. 288)
8. 1910—Kirby, (35: pp. 524-5)
9. 1920—Blatchley, (39: pp. 429-431)
10. 1925—Hebard, (46: p. 36)

b. Description:

The characteristic color of a large number of specimens from many different localities in Utah, displayed together is medium brown, varying in one direction towards yellowish or light brown and in the opposite direction towards deep brown. Among the specimens of lighter shade, some show a slight greenish tinge, and among the specimens of darker shade, a few show a purplish tinge. The conspicuous legs are generally a little lighter in color than the body.

Characteristic markings consist of longitudinal stripes on the head and prothorax, a dark medium stripe, bordered on each side by a much lighter stripe which traverses each shoulder, and this bordered by a blackish stripe on the upper half of side. The markings vary greatly from distinct to very faint; in none of the normal, mature specimens is there a complete absence of all of these stripes. The bright red or pinkish hind tibiae stand out conspicuously, only about one in fifty or more specimens show the tibiae blue.

Head of moderate size; face somewhat slant; compound eyes slightly elongate; *vertex* scutellate, declivent, closed anteriorily; frontal costa slightly narrowed at its beginning, slightly widening downward, then slightly narrowing as it approaches the clypeus. Three transverse incisions cross the dorsal surface of the thorax, the hindmost two continuous on the sides, the most posterior incision slightly behind the middle. Hind femorae with two darker spots crossing the upper margin; plain on the outside.

Tegminae nearly or quite unmarked, usually longer than the abdomen in both sexes; wings well developed, pellucid.

Cerci of the male widest at base, narrowest near the middle and spoon shaped at tip. Furculae widely divergent, extending one-third the length of the supra-anal plate. Subgenital plate strong, conspicuous and slightly pointed at tip.

The initial description by Scudder (13) is a good one. A more complete description is given by Scudder in a later publication (25) and also by Blatchley (39).

c. Measurements:

Male:

Body length:

Average for 100 specimens 28 mm.
Shortest body in 100 specimens 22 mm.
Longest body in 100 specimens 33 mm.

Hind femora length:

Average for 100 specimens 16 mm.
Shortest femur in 100 specimens 13 mm.
Longest femur in 100 specimens 19 mm.

Tegmina length:

Average for 100 specimens 23 mm.
Shortest tegmina for 100 specimens 18 mm.
Longest tegmina for 100 specimens 28 mm.

Female:

Body length:

Average for 100 specimens 33 mm.
Shortest body in 100 specimens 27 mm.
Longest body in 100 specimens 40 mm.

Hind femora length:

Average for 100 specimens 18 mm.
Shortest femur in 100 specimens 15 mm.
Longest femur in 100 specimens 22 mm.

Tegmina length:

Average for 100 specimens 24 mm.
Shortest tegmina for 100 specimens 20 mm.
Longest tegmina for 100 specimens 29 mm.

d. Geographical Distribution:

Melanoplus packardii (Scudder) was described in 1875 (13) from two male specimens taken at Dallas, Texas, and one female taken at Glencoe, Nebraska. Three years later the species was known by Scudder (18) to exist at Great Salt Lake, Utah, South Park and southern Colorado, at Wallula on the Columbia River and in British Columbia, besides Nebraska and Texas. In 1897, Scudder (25) added California, Oregon, Idaho, Montana, Wyoming, Iowa, Kansas, Arkansas, Nevada and New Mexico to the list of states where the species was known to range. Scudder's Index (27) adds Yellowstone, Assiniboine, North Dakota and Minnesota. Hebard (46) says the species is limited on the east to extreme western Minnesota and extreme western Iowa,

eastern Kansas, parts of Oklahoma and Texas, all the states westward and southwestern Canada. *M. packardii* ranges to high elevations, 8,000 to 10,000 feet, in the Rocky Mountains as found by Rehn in 1906 (33).

Summary distribution of *Melanoplus packardii* (Scudder) in Utah, is made from a collection of 163 males and 171 females taken in all counties except Morgan, Wasatch, Daggett, Wayne and Summit. Specimens were collected from 1921 to 1941 by the following workers: W. W. Henderson, G. F. Knowlton, F. K. Stoffers, F. C. Harmston, R. A. Zirker, W. L. Thomas, H. B. Stafford, A. W. Levi, C. J. Sorenson, H. J. Pack, M. J. Janes, F. H. Gunnell, B. J. Whitaker, O. Cannon, J. A. Meacham, and C. L. Nielson. Earliest seasonal date of collection, April 14; latest seasonal date, October 9.

e. Economic Importance:

Scudder said in 1878 (18) that *M. packardii* "is an abundant species" east of the Sierras to Nebraska and from British Columbia to Texas. Abundance of grasshoppers means destructiveness. Gillette recorded in 1904 (30) that it is a "common species over all the eastern portion of the state (Colorado) to the foothills and it also occurs in the grassy glades and mountain parks of the eastern slope to an altitude of 8,000 feet or more." Rocky Mountain states evidently provide a favorable environment for this species. On the other hand, Somes (36) records in 1914, "We have found it sparsely in dry sandy fields and along road sides at Granite Falls, Foxhome, Fergus Falls, Hibbing and Duluth" (Minnesota). Buckell (41) said in 1921 that *M. packardii* is "one of the species responsible for grasshopper outbreaks in Canada." Hubbell (44) pronounced it "moderately common" throughout the state of Michigan in 1922. Hebard (53) said that it is among those grasshoppers which severely menace crops in North Dakota, "one of the most destructive species" on the prairies and plains (47), "one of the most destructive species" in Montana (47) and "we have found it dangerously plentiful in cultivated areas a number of times." (48).

5. MELANOPLUS BIVITTATUS (Say) (See Pl. I fig. 3)

a. Synonymy:

1. 1825—Say, *Gryllus,* (4: p. 308)
2. 1862—Scudder, *Caloptenus,* (8: pp. 465-466)
3. 1873—Thomas, *Caloptenus,* (11: p. 158, 166)
4. 1878—Riley, *Caloptenus,* (17: p. 459)
5. 1897—Scudder, *Melanoplus,* (25: pp. 363-368)

6. 1897—Lugger, (24: pp. 296-298)
7. 1903—Caudell, (28: p. 799)
8. 1906—Rehn and Hebard, (34:)

b. Description:

A large number of specimens examined together look much like so many Packard locusts. They average larger in size than Packards, but in color and markings there is so close a resemblance that amateurs often confuse the two.

The predominating color is brown, ranging from yellowish into dark brown. Newly emerged specimens are light yellowish, often with a tinge of green; old specimens are dark brown with tegminae and wings often worn and shabby. The most conspicuous color markings consist of two long yellowish stripes each of which arises above and in front of the compound eye. The two stripes diverge as they pass caudad along the edge of the pronotum until they reach its tip and then converge down the humeral angle of the tegmina until they meet and continue as a single stripe which fades out toward the tip. The stripes enclose a brownish or yellowish spindle-shaped area on the back.

Head moderate in size, face somewhat slant, cheeks without conspicuous color markings. Scutellum of the vertex and temporal fovoelae feebly impressed in the male, obliterate in the female; frontal carina narrowest at the apex, only slightly widening below and feebly scutellate in the region of the central ocellus, more feebly in the female than the male. Compound eyes moderately large, nearly circular at base, the verticle radius only slightly greater than the horizontal. Antennae about as long as the front legs in the male, sub-equal in the female.

Pronotum widest behind, especially in the female; central carina low but conspicuous; three transverse incisions, the most posterior slightly behind the middle of the pronotum and more distant from the mid-incision than is the most anterior incision. Sides of the pronotum with a black line extending along the upper edge from the anterior margin to the third incision. Legs yellowish, front and middle pairs

Plate I

Fig. 1. Melanoplus Mexicanus Mexicanus (Saussure)
Fig. 2. Melanoplus Packardii (Scudder)
Fig. 3. Melanoplus Bivittatus (Say)
Fig. 4. Melanoplus Femur-Rubrum (De Geer)

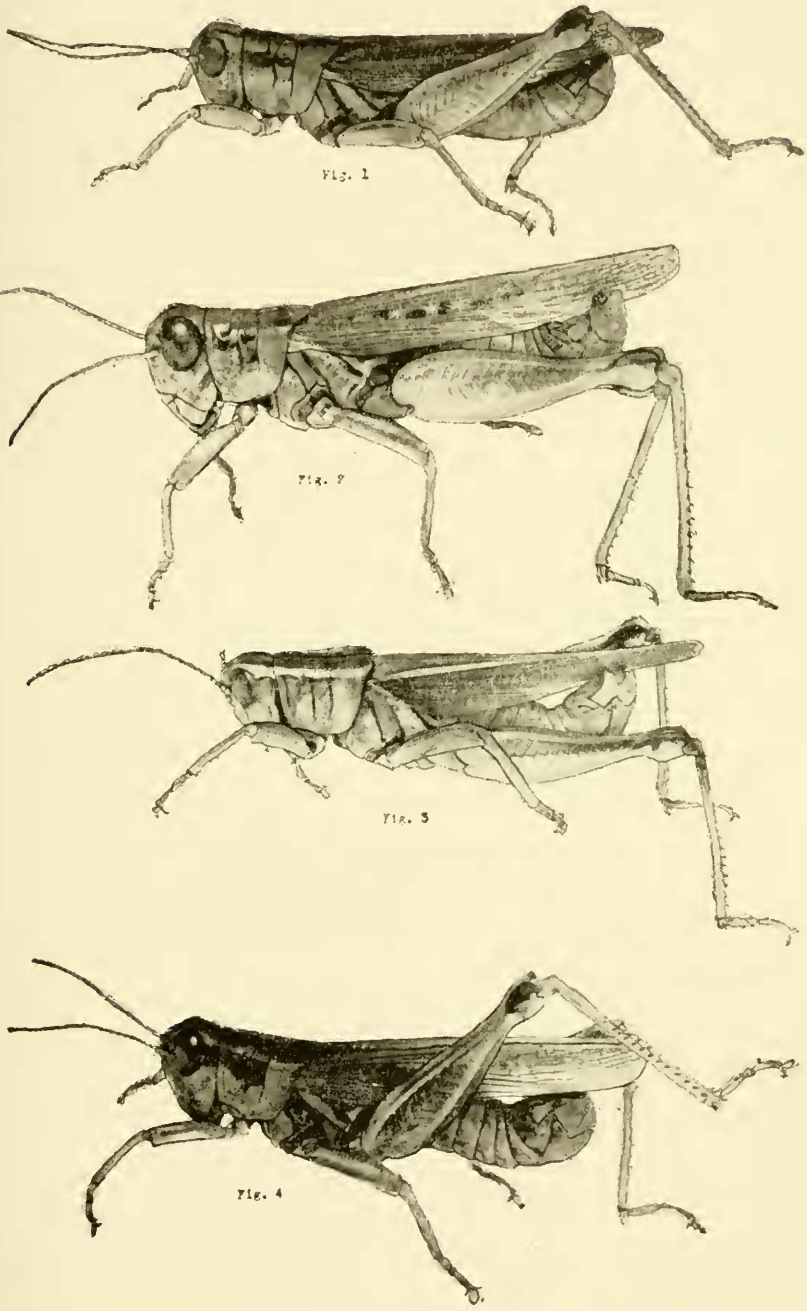

Plate I

without markings, hind legs with a blackish longitudinal stripe on the outer and upper surfaces of the femur, that on the upper edge sometimes discontinuous to form spots; hind tibiae yellowish to greenish black. Tegminae narrow and long, about equaling the abdomen in females but exceeding it in males. Wings medium long, broad and pellucid.

Abdomen elongate, yellowish and without color markings. Anal cerci of the male boot-shaped, viewed from the side with the tip of the boot farthest from the attachment to the body, heel directed posterio-ventrad; furculae vestigial. Subgenital plate with conspicuous tip, strongly elevated and pointed.

For more extensive and more technical description, see Scudder (25) or Blatchley (39).

c. Measurements:

Male:

Body length:

Average for 100 specimens 30 mm.
Shortest body in 100 specimens 26 mm.
Longest body in 100 specimens 35 mm.

Hind femora length:

Average for 100 specimens 24 mm.
Shortest femur in 100 specimens 21 mm.
Longest femur in 100 specimens 29 mm.

Tegmina length:

Average for 100 specimens 18 mm.
Shortest tegmina for 100 specimens 15 mm.
Longest tegmina for 100 specimens 24 mm.

Female:

Body length:

Average for 80 specimens 40 mm.
Shortest body in 80 specimens 32 mm.
Longest body in 80 specimens 48 mm.

Hind femora length:

Average for 80 specimens 28 mm.
Shortest femur in 80 specimens 24 mm.
Longest femur in 80 specimens 35 mm.

Tegmina length:

Average for 80 specimens 22 mm.
Shortest tegmina for 80 specimens 17 mm.
Longest tegmina for 80 specimens 25 mm.

d. Geographical Distribution:

In his "Materials for a monagraph of the North American Orthoptera," published in 1862, Scudder (8) gave the places where the species had been found as Massachusetts, Maine, Connecticut, Maryland, Texas, Nebraska, Illinois, Minnesota and Lake Winnipeg. In 1868 (9), he added "Atlantic states, western part of the country," and Baltimore. In 1872, Thomas (10) recorded the species as being "east of the (Rocky) mountains from New Mexico to Montana, and west of them, from Salt Lake to the North headwaters of the Snake River." The next year (11), 1873, he added states not mentioned before—New York, Pennsylvania, Carolina, Mississippi, Tennessee, Arkansas, Missouri, Kansas, Iowa, Dakota, Colorado, Wyoming, Utah, Idaho. In 1897, Scudder (25) added Ohio, Indiana, Manitoba, Yellowstone, Washington, and several locations in Canada and Mexico. In 1903, Caudell (29) found the species in Oklahoma. Hebard (52) and Ball (55) both record it for Arizona. There seems to be no record of its discovery as yet in Oregon and California or in Alabama and Florida. It is therefore known all over North America except the far north of Canada and the far south of Mexico and southward. It's distribution is apparently highly discontinuous, so that large stretches of territory within the greater limits of the range do not contain it. Scudder (25) says the species is "unknown along the Atlantic seaboard."

The collection of *Melanoplus bivittatus* (Say) in Utah, consists of 134 males and 95 females taken in the following counties: Box Elder, Cache, Weber, Davis, Tooele, Salt Lake, Utah, Wasatch, Duchesne, Uintah, Juab, Millard, Sanpete, Sevier, Emery, Grand, Washington, Kane, Garfield. It was collected by the following workers: W. W. Henderson, G. F. Knowlton, B. G. Whitaker, J. A. Meacham, T. O. Thatcher, R. Rosekelley, A. W. Levi, R. E. Nye, L. Nielson, H. B. Stafford, G. S. Stains, C. J. Sorenson, F. K. Stoffers, Newel Fowler, F. C. Harmston, R. A. Zirker, C. F. Smith, M. J. Janes, W. Thomas, Don Ashdown, Ted Anthon, and R. S. Roberts. Collections were taken from 1921 to 1941; earliest seasonal date, April 27, latest seasonal date, October 25.

e. Economic Importance:

Riley said in 1891 (23) that this species "often becomes locally abundant enough to do much damage to crops." This seems to be the earliest reference to the economic importance of *M. bivittatus*. In 1897, Lugger (24) reported it to be "a very common and destructive locust—found in all parts of the state" (Minnesota). By 1904 Gillette

(30) had discovered it to be "undoubtedly the most injurious grasshopper in Colorado." In more modern literature, Severin and Gilbertson (38) found it among the principal injurious grasshoppers of South Dakota. Morse (42) found it "common throughout New England," "sometimes doing much injury." Blatchley (39) recorded it "one of the most common of our early summer locusts, occurring everywhere throughout the state." (Indiana). Buckell (41) lists it among locusts which periodically cause severe injury to range land, vegetable crops and orchard trees in British Columbia. Morse (42) pronounced *M. bivittatus* "one of our four most dangerous species in the State" (Maine). Hubbel (44) said in 1922, "a considerable portion of the locust injuries are undoubtedly due to the ravages of this species." Corkins (45) found it "the most destructive (grasshopper) species known." It is probable that the last named author has reference to the state of Colorado. Mills (56) noted in 1942 that the species ranks second in importance in Montana. Hebard (53) found it one of "the most destructive species," and Ball's recent summary (55) seems to state the situation especially well when he describes the species as "one of the most injurious in the western United States."

6. MELANOPLUS FEMUR-RUBRUM (De Geer) (See Pl. I fig. 4)

a. Synonymy:

1. 1773—De Geer, *Acridium*, (1: p. 498)
2. 1788—Gmelin, *Cryllus* (*Locusta*) *erythropus*, (2: p. 2086)
3. 1791—Olivier, *Acrydium famorale*, (3: p. 228)
4. 1838—Burmeister, *Caloptenus*, (5: p. 638)
5. 1852—Harris, *Acrydium*, (6: pp. 151-152)
6. 1873—Thomas, *Caloptenus*, (11: p. 163)
7. 1883—Bruner, (21: p. 60)
8. 1897—Scudder, (25: p. 278)
9. 1910—Kirby, (35: p. 522)
10. 1928—Hebard, (47: p. 275)

b. Description:

The three colors, gray, brown and black, each losing itself somewhat in the other two, are the colors which prevail in *Melanoplus femur-rubrum* and in the order given. The purpose served in the harmonious blend of the three colors is to make the insect inconspicuous in its peculiar environment. In some pasture environments, some specimens show a yellowish tinge on the under parts, some show a greenish tinge on the upper parts.

Face nearly straight, that is, almost at right angles to the dorsal line of the head and pronotum. Compound eyes large, scarcely or not at all visible to each other over the vertex, upper tip more forward than the lower tip, front margin nearly straight, hind margin broadly rounded. Scutellum of the vertex well impressed, mostly anterior to the upper tips of the compound eyes and with lateral carinae conspicuous. Frontal carinae narrowest at the apex and widest where it nearly joins the clypeus. Antennae about as long as the head and pronotum together.

Dorsal surface of the pronotum nearly the same width throughout, with mid-dorsal carina low but conspicuous, cut by three transverse incisions, the three closest together at the dorsal carina, the third slightly, if at all, closer to the hind margin than the front. Sides of the pronotum with a conspicuous black band extending from the hind margin of the compound eye along the upper region to the third transverse incision. Tegminae and wings nearly, if not fully, devoid of color pattern, extending to the tip of the abdomen or slightly longer. First and second pairs of legs without color markings, the hind pair with three black spots along the upper, inner margin of the femur; tibiae red.

Abdomen variously colored from yellowish to blackish. Anal circi of the male nearly twice as wide in the basal half as in the distal half. Furculae two-thirds the length of the supra-genital plate, contiguous in the basal third, thence each narrowed on the inner side to the tip. Subanal plate with slightly sinuous, carinate margin.

c. Measurements:

Male:

Body length:

Average for 100 specimens 20 mm.
Shortest body in 100 specimens 18 mm.
Longest body in 100 specimens 24 mm.

Hind femora length:

Average for 100 specimens 12 mm.
Shortest femur in 100 specimens 10 mm.
Longest femur in 100 specimens 14 mm.

Tegmina length:

Average for 100 specimens 16.1 mm.
Shortest tegmina for 100 specimens 13 mm.
Longest tegmina for 100 specimens 20 mm.

Female:

Body length:
Average for 100 specimens 24 mm.
Shortest body in 100 specimens 19 mm.
Longest body in 100 specimens 28 mm.
Hind femora length:
Average for 100 specimens 13 mm.
Shortest femur in 100 specimens 10 mm.
Longest femur in 100 specimens 15 mm.
Tegmina length:
Average for 100 specimens 18 mm.
Shortest tegmina for 100 specimens 6 mm.
Longest tegmina for 100 specimens 23 mm.

d. Geographical distribution:

De Geer (1) described *M. femur-rubrum* from specimens sent to him from Pennsylvania. It may be assumed, therefore, that the species was first known from that state, in the year 1773. Harris says (6) that "It appears to be very generally diffused throughout the United States." Scudder (8) definitely records the species from Massachusetts, Maine, Connecticut, Illinois, Minnesota and Nebraska in 1862. Thomas (10) says in 1872, that Walker claimed to have found the species in Vancouver. The next year he (11) added New York, Maryland, Tennessee, Ohio, Missouri, Kansas, Colorado and Wyoming to previously known *femur-rubrum* territory. Thomas (15) added Iowa to the known distribution in 1876. The species was first collected in Utah by Dr. A. S. Packard in 1877 (20). In 1878, Scudder (18) reported the species from California, Oregon, Texas, Florida, as well as Canada and Mexico. He added Nevada (20) in 1880. When Scudder published his "Revision of Melanopli" in 1897 (25), his record of geographical distribution for *femur-rubrum* included all the states but ten, and many places in Canada and Old Mexico. Kirby (35) recorded the distribution as North America and Mexico in 1910 and Hebard (47) gave it in 1928 as "entire U. S.—Nova Scotia (to) British Columbia—to Atoyac in Vera Cruz."

Summary of distribution of *Melanoplus femur-rubrum* (De Geer) in Utah: 216 males and 176 females are represented in the Utah State collection, taken in the following counties: Box Elder, Cache, Rich, Weber, Davis, Salt Lake, Utah, Summit, Duchesne, Uintah, Juab, Millard, Sanpete, Sevier, Carbon, Emery, Grand, Washington, Wayne, Garfield, Kane and San Juan. They were collected by the following workers: W. W. Henderson, Geo. F. Knowlton, B. A. Haws, C. J.

Sorenson, E. W. Anthon, R. S. Roberts, F. C. Harmston, Geo. B. Harmston, A. W. Levi, C. L. Nielson, Don Fronk, E. G. Titus, E. J. Gardener, J. A. Meachem, R. E. Nye, T. A. Walquist, L. Cutler, Newel Fowler, D. M. Hammond, Geo. E. King, and H. J. Pack. Collections were made from 1907 to 1941 with the earliest seasonal date, May 15, and the latest, October 9.

e. Economic Importance:

Harris (6) said of *femur-rubrum*, in 1852, "It appears to be very generally diffused throughout the United States, and sometimes so greatly abounds, in certain places, as to be productive of great injury to vegetation." Fernald (22) wrote a quarter of century later, "one of the most common grasshoppers in New England." Riley (23) recorded in 1891, "abundant in Mississippi Valley"—"local damage more or less abundant throughout its range." A few years later, in 1897, Lugger (24) pronounced it "our most common locust (Minnesota) found everywhere and usually in very large numbers."

More recent findings have fully confirmed earlier observations. Gillette (30) writes, "next to *atlanis* the most generally distributed—next to *bivittatus* probably the most injurious species in Colorado." Fox (37) pronounced it "The dominant grasshopper of the Appalation province." Severin and Gilbertson (38) list it as "the principal injurious grasshopper" of South Dakota; Morse (42) says "Probably our most generally distributed and most injurious grasshopper"; Blatchley (39) calls it "the most common and one of the most injurious of our Indiana locusts"; Marcovitch (40) records "common throughout Tennessee — must be considered one of our economic forms"; Buckell (41) has the species listed among those responsible for grasshopper outbreaks in Canada; and again among locusts which periodically cause severe injury to range land, vegetable crops and orchard trees in British Columbia; Morse (42) again says the species "to which most injury done to crops is attributed" in Maine. Hubbell (43) mentions that it is "very common in marshes, lowlands and upland thickets and in forest margins, grassy fields and pastures, cultivated fields, etc." Corkins (45) pronounces it "commonly more abundant (than *mexicanus*) in cultivated fields"; Hebard (47) says it is "usually abundant and probably doing much damage in the aggregate"; but that (46) it "never appears in devastating multitudes"; and that (49) it is "particularly injurious to alfalfa" in Kansas. Ball (55) considered *M. femur-rubrum* to be "one of the most destructive grasshoppers of the United States and Canada."

7. GRASSHOPPER CONTROL IN UTAH

In recent years the United States Bureau of Entomology and Plant Quarantine, has cooperated with the states in a nation-wide grasshopper control program. Methods used have consisted largely in poisoning the insects with sodium arsenite, and in 1943 a sodium fluosilicate bait provided by the government, and used under direct supervision of the local organization. The following table gives an estimate of losses and crop savings effected by the federal-state-county grasshopper control program since 1937:

Table 1—Estimated crop losses, and savings resulting from grasshopper control, 1937–1943.

Year	Estimated Loss	Estimated Saving
1937	$950,000	$854,800
1938	650,000	1,062,350
1939	543,891	674,286
1940	424,363	439,087
1941	451,538	789,089
1942	730,687	797,760
1943	683,308	748,962
Total	$4,433,787	$5,366,334
Average	$ 633,398	$ 766,619

Prepared from material provided by Dr. G. F. Knowlton, state grasshopper control leader.

8. ACKNOWLEDGMENT

The four species of Orthoptera treated in this paper were determined by A. N. Caudel, former Curator of Orthoptera at the United States National Museum. The manuscript has been read and valuable suggestions given by Mr. James A. G. Rehn, Chairman, Publications Committee and Curator of Insects at The Academy of Natural Sciences of Philadelphia. Very much of value in this paper is due these scientists who are in no way responsible for any errors that may be found in the paper.

The illustrations are photographs made by Mr. Wm. C. Matthews of the University of California at Berkeley and retouched in pencil by the author.

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The European Earwig Found in Provo, Utah

In August of this year an insect, that was said to be a pest in the flower garden, was brought to me by Mr. Robert Curtis. He wanted to know what kind of insect it was and how it could be controlled. Upon examination of the specimens they were found to be *Forficula auricularia* Linn., the European Earwig, a new record for this area.

This species is dark brown in color, 10-15 mm. long, body flattened, winged and with well developed forcepts, at the posterior end of the body. The females hibernate by going down into the soil 8 to 10 inches. They come out in the spring, usually some time in April, depending upon the temperature. The female lays her pearly-white eggs, in small masses, in the moist soil or under debris. There is only one generation each year.

This cosmopolitan species has spread throughout the United States and is a serious pest in some areas. It can be controlled with a poison bait or contact spray. Dry white bread and lead arsenate, 16 pounds to one, mixed with a little water is recommended as an effective bait. The reader may get additional information concerning this species from the U. S. D. A. Bull. No 566 by D. W. Jones.

The following species of Earwigs are now known to occur in Utah:

Family Spongiphoridae

Spongovostox apicedentatus (Caud.), St. George, Utah, a tropical, semi-tropical species.

Family Labiidae

Labia minor (Linn.), Provo, cosmopolitan in distribution.

Family Forficulidae

Forficula auricularia Linn., Salt Lake City and Provo, cosmopolitan in distribution.—V. M. T.